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"Bacteriological Assessment of Poultry Water and Effect on Mortality and Egg Production of Caged Layers"

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Abstract

The mortality and egg production of caged layers in relation to the bacteriological analysis of their drinking water was assessed using 324 Harco layers aged 77 weeks. Birds were randomly divided into three groups (open drinker, nipple system and control). Each group consisted of 108 birds comprising 3 replicates of 12 cells with 3 birds per cell. Bacteriological analysis of water samples collected from source (borehole), storage tanks (open/drinking trough and nipple drinkers) showed that the total coliform counts (MPN/100 ml) was zero in all samples taken from borehole and the closed overhead tank outside the pen, while coliforms were detected in water samples from open storage tanks, and the open and nipple drinkers within the pens. Birds on open troughs laid more eggs than birds on the nipple drinking system. Mortalities due to diarrhea were however slightly higher in birds on open troughs. In resource scarce locations where there is a lack of technical expertise and fund to operate automated drinkers it is recommended that open drinker systems be combined with necessary precautions such as routine treatment of the water with sanitizers.

Introduction

Water is one of the most essential nutrients for the survival of livestock. It is functions in the digestion of food, transporting of nutrients, waste materials, hormones and other chemical messengers along the gastrointestinal tract (Olawuyi, 2006). The use of water high quality water is of fundamental importance to profitable poultry husbandry because large flocks of these species often share the same source of water. Low quality drinking water will adversely affect the livability and productivity of poultry birds. Contaminated drinking water plays a very important role in the transmission of many viral, bacterial and protozoan infections of poultry (WHO, 2004).

Problem Statement

There have been reports of increase in the incidence and severity of avian infections due to multi drug resistance strains of Enterobacteria (Haider et.al 2004; Lutful 2010), with the possibility of the levels of these infections rising in future and presenting great problems to the poultry industry. In Nigeria, *E. coli strains have* been isolated from all age groups of sick birds, and dead in shell embryos (Orajaka and Mohan, 1986; Raji *et al.*, 2003). This study was therefore carried out to determine the bacteriological quality of poultry drinking water obtained from different drinker systems and the effects on egg production and mortality levels of caged layers.

Materials and Methods

A total of three hundred and twenty four (324) Harco black laying hens aged 77 weeks were randomly divided into three groups in battery cages, based on the type of watering system namely; open (trough) drinkers, nipple system and control. Each group consisted of 3 replicates with 12 cells each, 3 birds per cell, and a total of 108 birds. Birds were fed twice daily with compounded ration having a nutrient value equivalent to 16.0% crude protein, 2700 Kcal/kg Metabolizable Energy, 0.60% Lysine, 0.30% Methionine; 3.50% calcium, 0.45% phosphorus. The overhead storage tanks, water lines, nipple drinkers and troughs were filled and flushed with Aquaclean™ (a water sanitizer). Records of daily egg production and mortalities were kept for eight weeks. Water samples were analyzed using the Multiple tube fermentation technique (MTFT) for assessment of the microbial quality (Buxton and Fraser, 1997) at four weeks interval, while the number of total coliforms in each water sample was estimated by the most probable number (MPN) method. Data collected were subjected to analysis of variance using SPSS (SPSS 1996).

Results and Discussion

- Table 1 and 2 shows that samples collected from open troughs had bacteria growth that was too numerous to count (TNTC), samples from NDS, OTIt and OTIc were also found with *E. coli*, clostridium and streptococcus while samples from BHS and OTO were free from *E. coli.* The differences were probably due to contamination of OTI(t)and OTI(c) because both tanks had no lids, and probably because the water sanitizer was ineffective.
- Microbial load of water samples from OTO and BHS were not significantly different ($P>0.05$) because OTO was fed from BHS and both sources were covered.
- From tables 3 and 4, number of eggs laid by the birds on the ODS was significantly different ($P<0.05$) from those on NDS but the weights of eggs were not different, ($P>0.05$), indicating the importance of water in egg production.
- A numerically higher number of mortalities were recorded amongst layers on open drinking troughs and the control as compared with birds on nipple drinker system. Open water supplies such as troughs and bell drinkers have been reported to present high contamination levels of pathogenic bacteria and higher levels of infection (Carr *et al.,* 1988).

Conclusion and Recommendations

- Study indicates that open drinking system encourages higher microbial load and hence susceptibility to infection.
- It is recommended that in resource scarce location where automated drinker system is not feasible, open drinker system should be practiced with routine water treatment to reduce mortality due to infection; nipple-drinking system should also be accompanied by regular flushing of the pipes, water channels and drinkers.

Reference

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Table 1: Colony counts using the Most Probable Number (MPN) of Coliforms

Sample Code	Collections made	Coliform Count using MPN of coliforms							
		24hrs				48hrs			
		10^{-5}	Remark	10^{-7}	Remark	10^{-5}	Remark	10^{-7}	Remark
OTO	1st	8	S.f.d	6	s.f.d	6	s.f.d	2	s.f.d
	2nd	52	n.s.f.d	18	n.s.f.d	66	n.s.f.d	5	s.f.d
	3rd	1	s.f.d	1	s.f.d	6	s.f.d	1	s.f.d
ODS	1st	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d
	2nd	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d
	3rd	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d
OTI(t)	1st	19	n.s.f.d	4	s.f.d	27	n.s.f.d	4	s.f.d
	2nd	TNTC	n.s.f.d	29	n.s.f.d	TNTC	n.s.f.d	19	n.s.f.d
	3rd	TNTC	n.s.f.d	4	s.f.d	TNTC	n.s.f.d	6	s.f.d

OTI(c)	1st	19	n.s.f.d	11	n.s.f.d	TNTC	n.s.f.d	15	n.s.f.d
	2nd	TNTC	n.s.f.d	172	n.s.f.d	TNTC	n.s.f.d	TNTC	n.s.f.d
	3rd	21	n.s.f.d	3	s.f.d	8	s.f.d	1	s.f.d
NDS	1st	73	n.s.f.d	4	s.f.d	26	n.s.f.d	3	s.f.d
	2nd	18	n.s.f.d	16	n.s.f.d	12	n.s.f.d	8	s.f.d
	3rd	240	n.s.f.d	1	s.f.d	10	s.f.d	2	s.f.d
BHS	1st	16	n.s.f.d	3	s.f.d	3	s.f.d	1	s.f.d
	2nd	3	s.f.d	1	s.f.d	1	s.f.d	1	s.f.d
	3rd	1	s.f.d	1	s.f.d	1	s.f.d	1	s.f.d

Keys: TNTC=too numerous to count (> 300CFU) OTO=overhead tank outside
n.s.f.d=not suitable for drinking ODS=open drinking system
OTI (t) =overhead tank inside test s.f.d=suitable for drinking
BHS =Borehole source NDS=Nipple drinker system

Table 2: Morphological characteristics of bacteria isolates from water samples

Sample code	Colour	Size(mm)	Surface	Shape	Elevation	Consistency	Odour	Opacity	Blue litmus test	Separated organism
OTO	White	4-5	Serrated	Rod	Flat	Soft	None	Opaque	NAG	*Clostridium*
ODS	Green	2-6	Smooth	Cocci	Raised	Soft	Flowery	Opaque	A	*E. coli*
NDS	Pink	2-4	Smooth	Rod	Slightly raised	Soft	Flowery	Opaque	AG	*Clostridium*
OTI(C)	Pink	2-4	Smooth	Rod	Slightly raised	Soft	Flowery	Opaque	AG	*Streptococcus*
OTI(T)	Pink	2-4	Smooth	Rod	Slightly raised	Soft	Flowery	Opaque	AG	*Streptococcus*
BHS	White	4-5	Serrated	Rod	Flat	Soft	None	Opaque	NAG	*Clostridium*

Keys: OTO=overhead tank outside ODS=open drinking system
OTI (t) =overhead tank inside test OTI(c) =overhead tank inside control
NAG= No acid and gas production AG= acid and gas production
NDS=nipple drinking system A= acid production
BHS=borehole source

Table 3: Egg weight (g)

Week	Open	Nipple	Control
1	65.09	63.76	65.45
2	63.89	63.59	64.33
3	65.20	65.61	65.54
4	66.85	64.94	63.77
Total	261.03	257.90	257.09
Mean	65.26[a]	65.20[a]	64.77[a]

Mean values with same superscript are not significantly different (P>0.05).

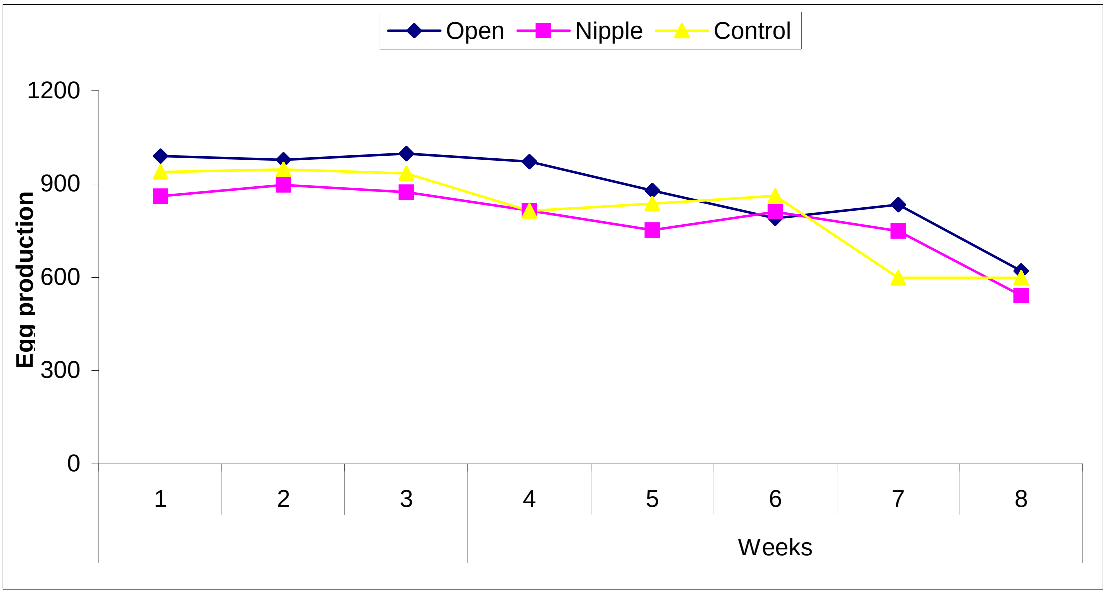

Fig. 1: Weekly egg production pattern

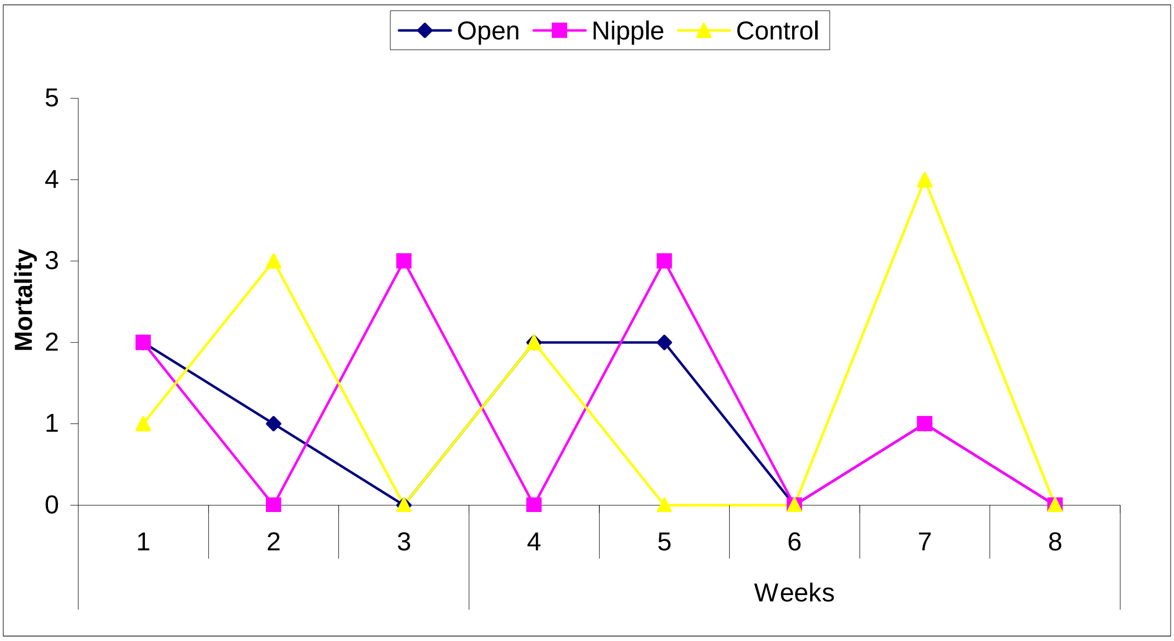

Fig. 2: Weekly mortality pattern

Table 4: Summary of total weekly egg production and mortality record

Open		Nipple		Control	
Egg production	Mortality	Egg production	Mortality	Egg production	Mortality
238^a crates 22 pieces	8	210^b crates, 13 pieces	7	226^a crates 13 pieces	10

Note: the observations of the mortalities recorded in table 4 below are as follows:

Open: 8 mortalities→ 2 pecking, 5 diarrhea, 1 unknown

Nipple: 7 mortalities→6 pecking, 1 diarrhea

Control: 10 mortalities→8 pecking, 2 diarrhea

Mean values with same superscript are not significantly different (P>0.05).